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Large mass expansion in two-loop QCD corrections of para-charmonium decay

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We calculate the light-by-light scattering type two-loop QCD corrections due to the light quark loops in the para-charmonium decays $\eta_c \rightarrow \gamma\gamma$ and $\eta_c \rightarrow gg$. We replace the mass of the internal charm quarks by an artificial large mass and obtain the result as a series in the large mass. The obtained series can be transformed into the good convergent ones by a change of the expansion parameter. The results are supported by two other methods to improve the convergence. We also observe that the color singlet state of η_c eliminates the potential divergences in the two-loop QCD corrections. The obtained corrections to the modes $\eta_c \rightarrow \gamma\gamma$ and $\eta_c \rightarrow gg$ account for -1.25% and -0.73% of the tree level values, respectively.

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